



**ACTUATORS & CONTROLS**

# **SRD Series Spring-Diaphragm Actuators**



## **Instruction Manual**

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## 1, About IOM

This instruction manual contains important information regarding the operational principle, the installation, operation and troubleshooting of SRD Spring-Diaphragm Actuators. This unique spring-diaphragm actuator designed for rotary valves provides safe, smooth and reliable valve actuation at minimal pressures 0.8 Bar up to 7 Bar (12 - 100 PSI). Please read these instructions carefully and save them for further reference.



### 1.1, WARNING

KEEP HANDS AND CLOTHING AWAY FROM THE VALVE PORTS AT ALL TIMES.

DO NOT ATTEMPT TO DISASSEMBLE THE SPRING CARTRIDGE. DISASSEMBLY OF THE SPRING PACKAGE MAY RESULT IN SERIOUS PERSONAL INJURY. IF MAINTENANCE IS REQUIRED, THE ENTIRE ACTUATOR MUST BE RETURNED TO DESIGNATED FACTORY CLOSE-BY.

SHUT-OFF AND BLEED ALL SUPPLY LINES BEFORE INSTALLATION OR SERVICING. DO NOT REMOVE DIAPHRAGM CASING HEX HEAD SCREWS (35), NUTS (20) OR DIAPHRAGM CASING (38) WHILE ACTUATOR IS PRESSURIZED.

BEFORE INSTALLING THE VALVE AND ACTUATOR, BE SURE THAT THE INDICATOR POINTER (2) ON TOP OF THE ACTUATOR AND THE INDICATOR PLATE (4) ARE CORRECTLY INDICATING THE VALVE POSITION. FAILURE TO ASSEMBLE THESE PRODUCTS TO INDICATE THE CORRECT VALVE POSITION COULD RESULT IN PERSONAL INJURY.

AN ACTUATOR MUST BE SIZED ACCURATELY FOR PROPER OPERATION. REFER TO INFORMATION ON ACTUATOR END OF STROKE TORQUES AND THE APPROPRIATE VALVE BULLETIN FOR OPERATING TORQUES.

WHEN SERVICING A VALVE ACTUATOR ASSEMBLY, THE BEST PRACTICE IS TO REMOVE THE ENTIRE ASSEMBLY FROM SERVICE. IF THE ACTUATOR IS REMOVED FROM THE VALVE, IT SHOULD BE REMOUNTED ON THAT SAME VALVE AFTER SERVICING IS COMPLETED. THE ACTUATOR MUST BE READJUSTED FOR PROPER OPEN AND CLOSE POSITION EACH TIME IT IS REMOUNTED.

ACTUATORS ARE NOT TO BE LIFTED USING THE 1/4" NPT IN THE DIAPHRAGM COVER (38). HANDLING OF THE ACTUATOR IS ACCOMPLISHED BY USING LIFTING STRAPS. SEE SECTION 1.2.

## 2, Operation

The operating pressure, output torque and drive type are determined by the actuator designation.

Maximum operating pressure is 100 psi (7.0 BAR). (See Table 2.0)

Actuator designation example:SRD4C-MJ-FS-MN is a SRD4 spring diaphragm actuator that has a 50 - 70 psi (3.4 - 4.8 Bar) spring, an end of spring stroke output torque of 2752 IN•LBS (311 N•m) and uses a 27×27 mm female double square and F05 + JB51 + F07 mount configuration to connect and drive the valve. This actuator is with Namur stem.

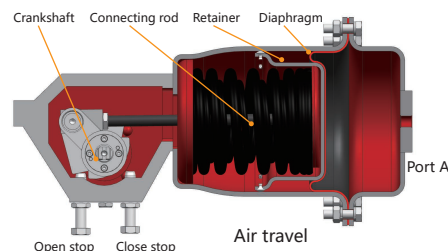
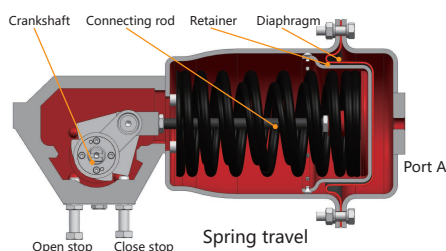
TABLE 2.0										
Actuator Series	Flange Mount Configuration		Spring Version	Operating Pressure in psi (BAR)	End of Spring Stroke Torque in IN•LBS (N•m)	Drive Type**				
	MI	MJ				Female Double squares (FS)	Female Keyed (FK)	Female Double D (FD)	Male Square / Star (MQ / MT)	Male Double D (MD)
SRD2	F05 + F07	F05 + JB51 + F07	A	15 - 30 (1.0 - 2.0)*	150 (17)	14×14 mm	14 mm	14 mm	17 mm	14 mm
			B1	30 - 50 (2.0 - 3.4)	425 (48)					
			B2	50 - 70 (3.4 - 4.8)	575 (65)					
			C	60 - 80 (4.1 - 5.5)	779 (88)					
			D	70 - 90 (4.8 - 6.2)	885 (100)					
SRD3	F07 + F10	JB76 + F10	A	15 - 30 (1.0 - 2.0)*	363 (41)	22×22 mm	22 mm	22 mm	22 mm	22 mm
			B1	30 - 50 (2.0 - 3.4)	885 (100)					
			B2	50 - 70 (3.4 - 4.8)	1186 (134)					
			C	60 - 80 (4.1 - 5.5)	1434 (162)					
			D	70 - 90 (4.8 - 6.2)	1797 (203)					
SRD4	F10 + F12	F10 + JB108 + F12	B1	30 - 50 (2.0 - 3.4)	1682 (190)	27×27 mm	36 mm	27 mm	27 mm	27 mm
			B2	50 - 70 (3.4 - 4.8)	2319 (262)					
			C	60 - 80 (4.1 - 5.5)	2814 (318)					
			D	70 - 90 (4.8 - 6.2)	3646 (412)					
SRD5	F10 + F14	F10 + JB108 + F14	B1	30 - 50 (2.0 - 3.4)	3664 (414)	36×36 mm	42 mm	36 mm	36 mm	36 mm
			B2	50 - 70 (3.4 - 4.8)	4921 (556)					
			C	60 - 80 (4.1 - 5.5)	6151 (695)					
			D	70 - 90 (4.8 - 6.2)	7133 (806)					
SRD6	F16	-	B1	30 - 50 (2.0 - 3.4)	6593 (745)	46×46 mm	50 mm	46 mm	46 mm	46 mm
			B2	50 - 70 (3.4 - 4.8)	8496 (960)					
			C	60 - 80 (4.1 - 5.5)	9894 (1118)					
			D	70 - 90 (4.8 - 6.2)	12682 (1433)					

\* For Direct Control Applications; \*\* It is available to customize the drive type without additional cost.

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### 2.1, Operating Principle

**Spring travel:** Lose of air pressure on port A, the stored energy in the springs forces the diaphragm retainer and connecting rod moving rightwards and crankshaft be rotated clock-wise which is limited by adjustable close stop. In the most application, the spring travel also is valve close travel.



**Air travel:** Air pressure to port A, forces the diaphragm retainer and connecting rod moving leftwards, causing the springs to be compressed and the crankshaft will be rotated counter clock-wise which is limited by adjustable open stop. In the most application, the air travel also is valve open travel.

## 3, INSTALLATION

### 3.1, Handling SRD Actuators

Handling of the actuator is to be accomplished by using lifting straps. See Table 3.1 for approximate actuator weights. Follow Figure 3.1 for proper strap lifting technique.

TABLE 3.1	
Handling SRD Actuators	
Actuator Series	Approximate Weight Kg (Lb.)
SRD2	21 / 46
SRD3	35 / 77
SRD4	58 / 128
SRD5	107 / 236
SRD6	177 / 390

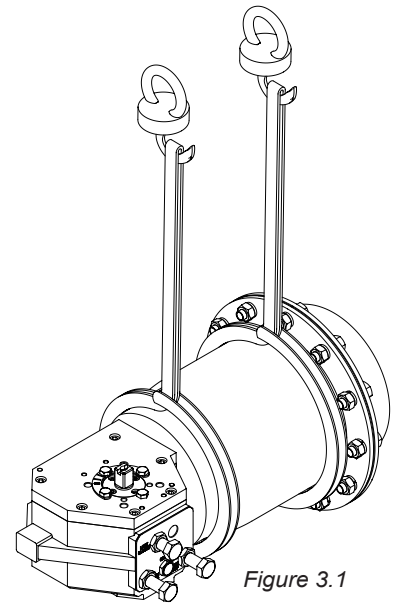
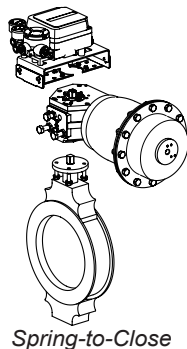


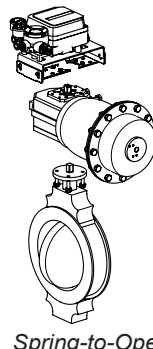
Figure 3.1

### 3.2, Mount with valve and accessories

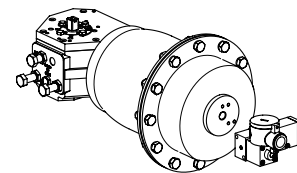
- 1, Check to see that the position indicator on the actuator is assembled correctly for the desired failure mode, either spring-to-close or spring-to-open. In the spring-to-close mode, the actuator will cycle clockwise to close upon loss of pressure. In the spring-to-open mode, the actuator will cycle counterclockwise to open upon loss of pressure.
- 2, If the actuator is not set up in the configuration desired, remove the four hex head screws (3), indicator plate (4), indicator pointer (2), and remount them on the opposite mounting surface.
- 3, Mount the actuator to the valve following ISO5211 standard, the valve IMO and the directions below: In spring-to-close mode, closing the valve and then mounting the actuator on the valve; In spring-to-open mode, opening the valve, inverting the actuator and then mounting the actuator on the valve.



Spring-to-Close



Spring-to-Open



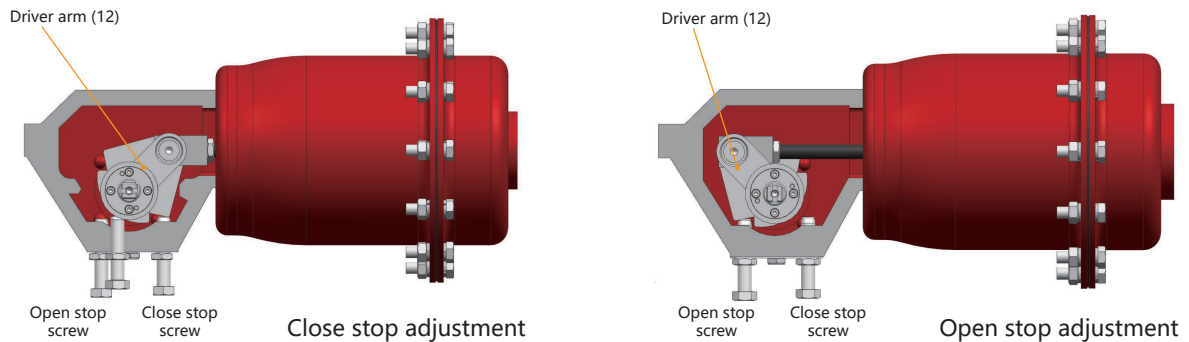
Mount Namur solenoid valve

- 4, Mount the accessories, such as limit switch box or valve positioner, to the actuator following Namur (VDI/VDE 3845) standards, the accessory can be directly mounted on the cover (8) of the actuator in spring-to-close mode. In spring-to-open mode, the accessory can be directly mounted on the driver housing (13) of the actuator.

- 5, Mount Namur solenoid valve to the actuator following Namur (VDI/VDE 3845) standards for directly installing on the diaphragm cover (38). It is available to connect a regulated air supply to the 1/4" NPT fitting in the diaphragm cover (38). CAUTION: The maximum operating pressure is 100 psi (6.9 BAR).

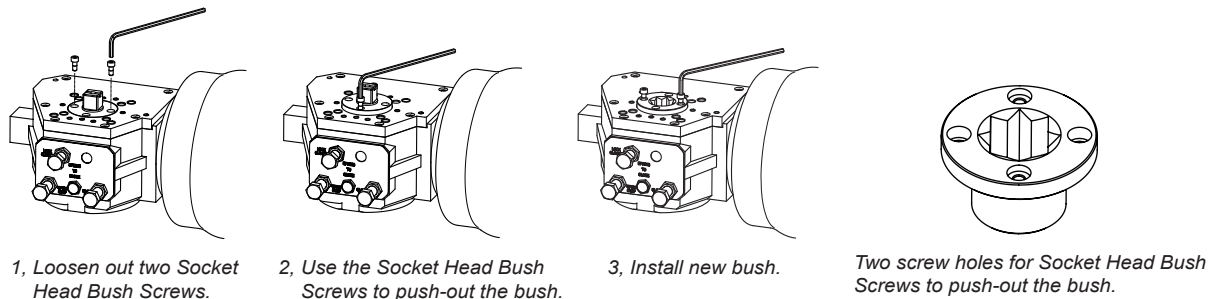
## 3.3, Valve Position Limit Adjustment

Adjust the stop screws (17) by releasing the hex jam nut (17.1) and turning. Stops can only be adjusted when driver arm (12) is off the stop screws being adjusted. (Maximum rotation adjustment  $\pm 5^\circ$ ) Be sure to retighten hex jam nut (17.1) after adjustment.



## 3.4, Drive Bush Disassemble and Assemble

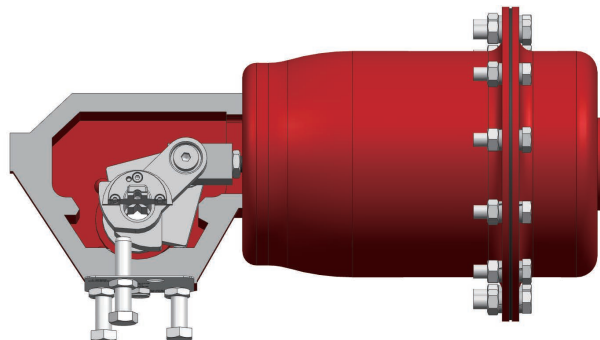
Removable drive bush (19) is available to quickly disassemble and assemble in line of following steps for choice of drive style, such as double square, double D and keys in female or square, star and double D in male.



Be sure to keep the bush in equilibrium when push-out. After installing new bush, be sure to retighten the Socket Head Bush Screws (5).

## 3.5, Mechanical Lockout

SRD allows to be locked in the spring failure mode. Adjust the set screw (16) by releasing the hex jam nut (16.1) and turning, the actuator will be locked in any position from close to open.



*Mechanical Locked in the spring failure mode*

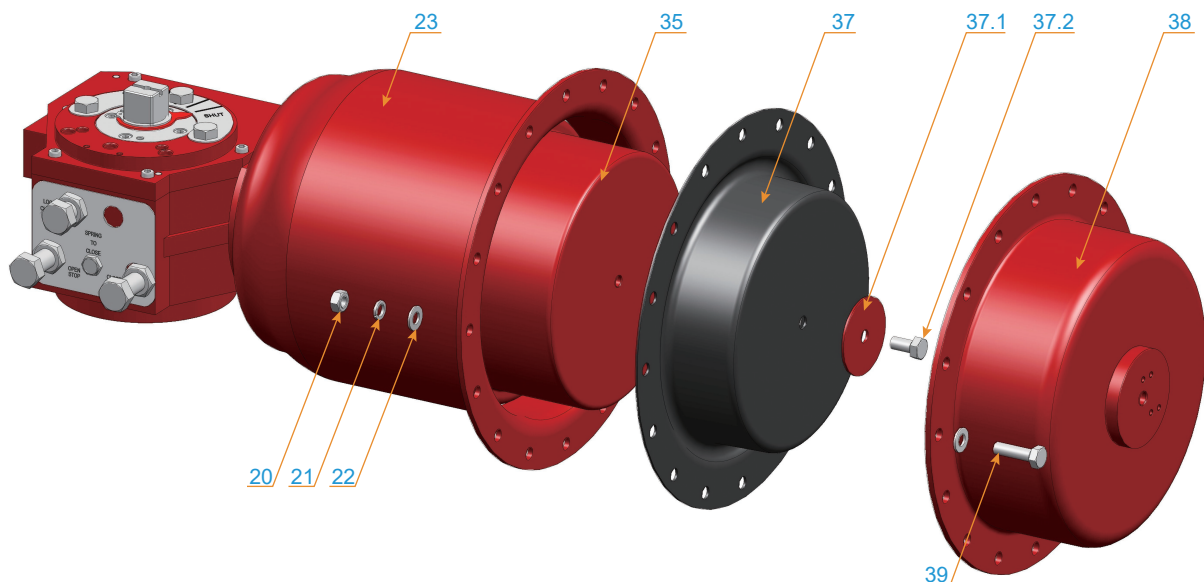
## 4, MAINTENANCE

Before working and maintenance on a SRD actuator, note that all fasteners and screw threads are metric and only JB mount screw threads are British system.

Under normal operating conditions the actuator requires only periodic observation to ensure proper adjustment. Standard replacement of “soft” parts in SRD actuators consists of items numbered 9, 37, 10, 25 and 34. See REPAIR KITS/SPARE PARTS Section.

### 4.1, Replacing the diaphragm

- 1, When replacing the diaphragm use caution and be sure the air supply is disconnected. Back off nuts (20) from the hex head screws (39), holding the diaphragm casing and spring housing together until the nuts are flush with the hex head screw ends. Do not remove the nuts completely from the hex head screws. If tension still exists on the hex head screws, then the spring package is not properly contained. Stop disassembly: retighten nuts and return the actuator to the factory. If the spring package proves to be intact, remove the nuts (20), spring-washers (21) and gaskets (22) and remove the hex head screws (39).



- 2, Lift off diaphragm cover (38). For the actuator of SRD4, SRD5 and SRD6, remove hex head cap screw (37.1) and retaining washer (37.2) firstly. Remove diaphragm (37).
- 3, Inspect the inside of both the diaphragm cover (38), the diaphragm retainer (35) and the spring housing (23) for any rough spots or foreign matter which may cause abrasion to the diaphragm.
- 4, Place the new diaphragm (37) on the diaphragm retainer (35). Do not pinch or stretch the diaphragm. For the actuator of SRD4, SRD5 and SRD6, attach with washer (37.2) and cap screw (37.1). Tighten to value in (Table 3). Keeping spring housing (23) holes aligned with diaphragm (37) holes. Place the diaphragm cover (38) on the spring housing (23) and line up all the holes.
- 5, Insert hex head screws (39) in all holes. Do not force the hex head screws through the diaphragm. Install spring-washers (21), gaskets (22) and nuts (20) on screws and tighten uniformly using the standard practice of tightening diametrically opposite bolts in sequence with the torque requirements from (Table 4.3).

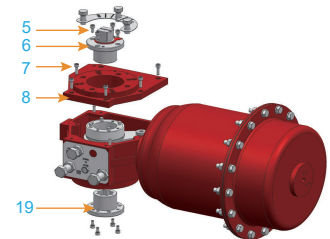


## 4.2, Disassembly

When disassembly of the actuator is required for maintenance and/or for replacing the spring cartridge, remove the actuator to a clean well lit area. Handling of the actuator is accomplished by using lifting straps. See Section 3.1.

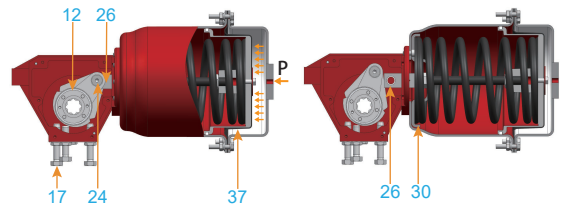
Prior to disassembling the actuator, obtain the following tools: two M10 wrenches, preferably one being a ratchet, one hex (Allen) wrench, 5 mm for SRD2, 3 and 4, 6 mm for SRD5, one screwdriver, one plastic faced mallet.

- 1, Remove the drive bush (19) by removing two socket bush screws (5). Use two socket cap screws (5) to push-out the drive bush (19) from the actuator. Do the same for Namur Stem (6). Be sure to keep the bush in equilibrium when push-out.



- 2, Remove the cover (8) by removing six socket cap screws (7). If the cover cannot be removed, tap it with a plastic hammer to break the adhesion of the paint between the body and cover joint.

- 3, Use air pressure to remove spring preload by partially stroking the actuator. If the diaphragm (37) is ruptured, replace as instructed in the previous section.



- 4, To remove the socket shoulder screw (24) that holds the clevis (26) to the driver arm (12).

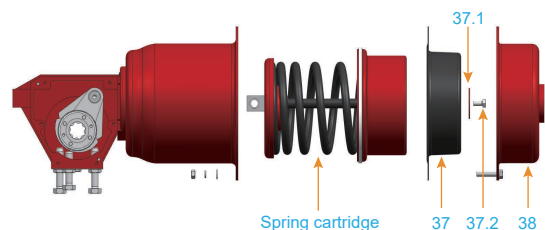
- 5, Slowly increase air pressure until the driver arm (12) moves slightly off the stop screw (17). Remove the socket shoulder screw (24). See left diagram above.

- 6, Slowly relieve the air pressure in the actuator. The clevis (26) should be set against the spring retainer (30), and positioned symmetrically about the slot in the spring housing seeing right diagram above.

- 7, Shut off and bleed the air pressure to zero. Disconnect the air lines.

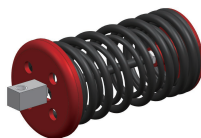
- 8, Remove the hex head screws (39) and hex nuts (20) holding the diaphragm cover (38) and spring housing (23) together.

- 9, Lift off diaphragm cover (38). For the actuator of SRD4, SRD5 and SRD6, remove hex head cap screw (37.1), washer (37.2). Remove the diaphragm (37). Inspect the diaphragm for signs of wear, rupture or mechanical damage.

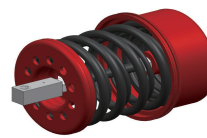


- 10, Inspect the inside of both the diaphragm cover and spring housing, as well as the outside of the diaphragm retainer for any rough spots or foreign matter which may cause abrasion of the diaphragm.

- 11, Lift the entire spring cartridge out of the unit.



Spring cartridge of ASD2 and ASD3



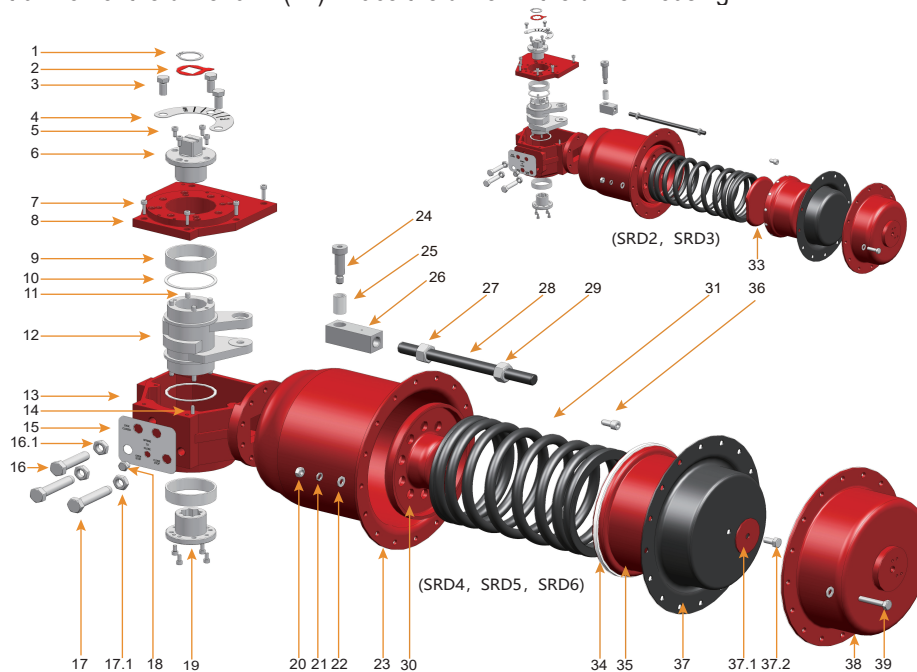
Spring cartridge of ASD4, ASD5, ASD6

**WARNING:** DISASSEMBLY OF THE SPRING PACKAGE SHOULD NOT BE ATTEMPTED. SPECIAL EQUIPMENT IS REQUIRED. DISASSEMBLY OF THE SPRING PACKAGE MAY RESULT IN SERIOUS PERSONAL INJURY. IF MAINTENANCE IS REQUIRED SHIP THE ENTIRE ACTUATOR TO FACTORY. It is usually not necessary to remove the spring housing (23) from the driver housing (13). However, if removal is required, the information in (Table 4.3) must be met. Inspect and clean all components.

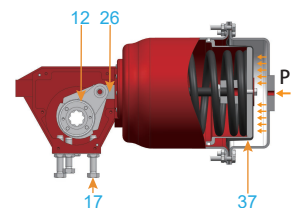
## 4.3, Assembly

To aid assembly, spread light oil or grease on the outside diameter of the new bearings.

- 1, Press driver arm bearings (9) into the driver housing (13) and covers (8). This is best done in an arbor press, but a vise could be used if care is taken not to damage the bearing. Driver arm bearings are to be pressed in until they are flush or 0.015 in. (0.38 mm) below the driver housing counterbore or the inside cover surface. Press clevis bearings (25) into the clevis (26).
- 2, Apply grease to inside of bearings for the driver arm, but not for the clevis. The shoulder screw (24) barrel needs to be greased instead.
- 3, Place the thrust bearing (10) into the counterbore in the driver housing of actuators. Slide the other thrust bearing onto the trunnion of the driver arm (12). Place the driver in the driver housing.



- 4, Place the thrust bearing (10) into the counterbore in the driver housing of actuators. Slide the other thrust bearing onto the trunnion of the driver arm (12). Place the driver in the driver housing (13). Lower the spring cartridge into the spring housing (23). Make sure that the spring package is not resting on the hex head cap screws (36) which hold the spring housing and driver housing together. If bearing (34) has separated from diaphragm retainer (35), hold in place while lowering spring cartridge into housing.
- 5, Place the new diaphragm (37) on the diaphragm retainer (35). Attach diaphragm (37) to diaphragm retainer (35). For the actuator of SRD4, SRD5 and SRD6, please using washer (37.2) and hex head cap screw (37.1). Torque to the value specified in (Table 4.3).
- 6, Insert the hex head bolt (39) in all holes. Do not force the bolts through the diaphragm. Install nuts (20) and tighten uniformly using the standard practice of tightening diametrically opposite bolts in sequence. Follow (Table 4.3) for tightening torques.
- 7, Connect a regulated air supply to the pressure port and slowly increase the air pressure until the holes in the clevis (26) and driver arm (12) are aligned seeing diagram right. Turn clevis a few degrees, if required, to align holes.
- 8, Apply grease on the threads of the shoulder screw (24). Install it through the driver arm (12) and clevis (26). Tighten per (Table 4.3). As the shoulder screw is being tightened, firmly hold the clevis with a wrench, since the unsupported driver arm may tend to tip over.
- 9, Slowly release air pressure. Assemble cover (8) by using the socket head screws (7). Apply tightening torque per (Table 4.3).

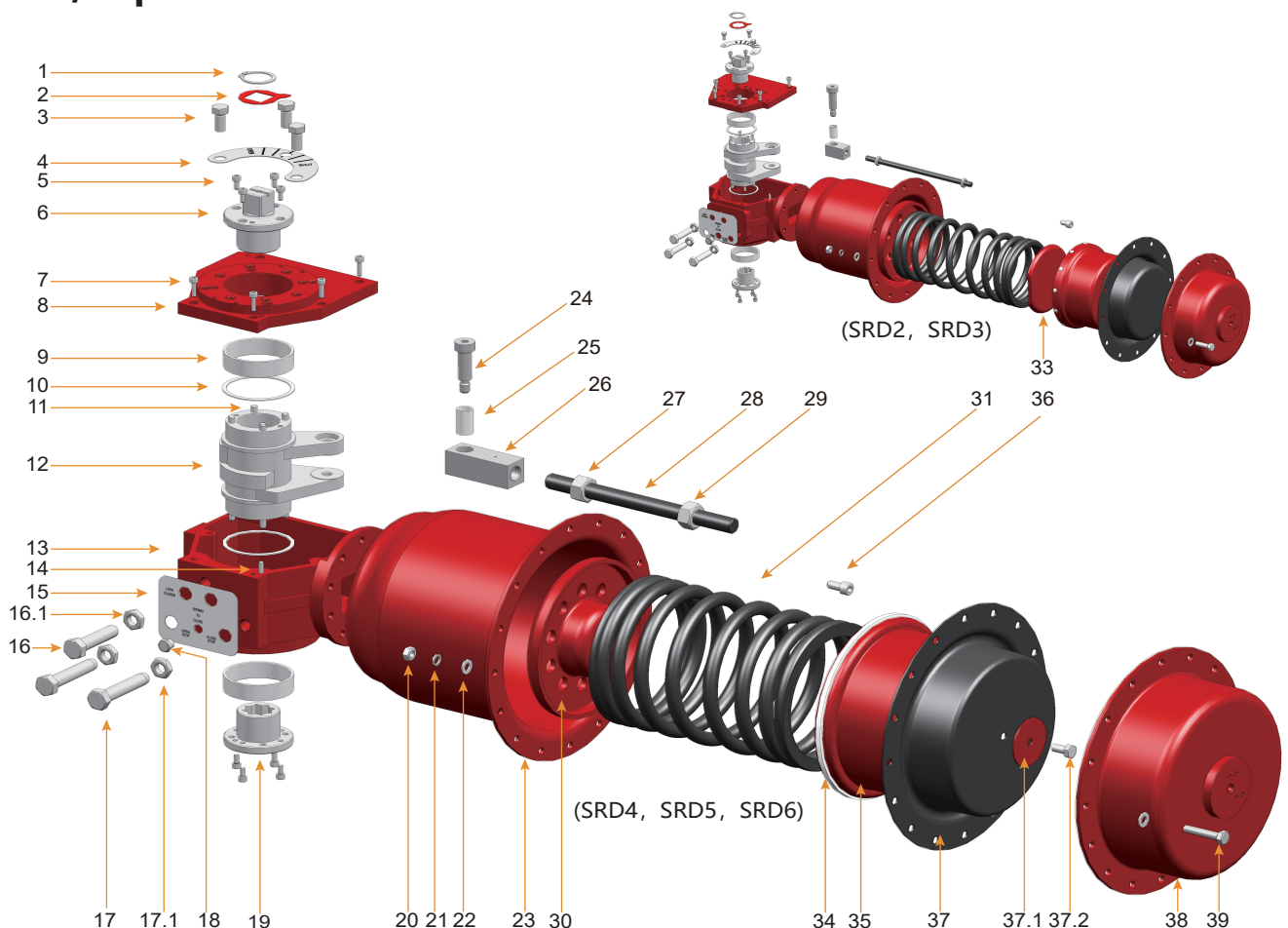




- 10, Install the drive bush (19) on driver Arm (12). Be sure that four cylindrical pins (11) are aligned with cylindrical holes in driver bush (19). Tap the bush with a plastic hammer to insert the bush into good position. Install two socket head bush screws (5) and tighten the bush uniformly using the standard practice of tightening diametrically opposite bolts in sequence. Follow (Table 4.3) for tightening torques. Do the same as drive bush for Namur stem (6).
- 11, Install the indicator pointer (2) and Indicator Plate (4), if this was previously disassembled. NOTE: Refer to Installation instructions for spring-to-close or spring-to-open configuration.

TABLE 4.3					
Torque Requirements					
Required Tightening Torques In FT•LBS (N•m) For Various Fasteners					
	SRD2	SRD3	SRD4	SRD5	SRD6
Nuts for Hex Head Screws through Diaphragm Casing (20)	24 (32)	24 (32)	24 (32)	24 (32)	24 (32)
Socket Head Cover Screws (7)	6 (8)	6 (8)	6 (8)	15 (20)	24 (32)
Socket Head Shoulder Screw (24)	55 (75)	132 (179)	132 (179)	132 (179)	132 (179)
Socket Head Bush Screw (5)	4 (6)	5 (7)	6 (8)	11 (15)	15 (20)
Hex Head Screws between Driver Housing and Spring Housing (36)	18 (24)	30 (40)	30 (40)	55 (75)	55 (75)
Hex Head Cap Screws for Attaching Diaphragm to Diaphragm Retainer (37.1)	19 IN•LBS (1)	27 IN•LBS (2)	10 FT•LBS (14)	17 FT•LBS (23)	17 FT•LBS (23)

## 4.4, Exploded view



## 4.5, Bill of Material & Parts List

NO.	Part Name	Qty			Material	Surface treatment
		SRD2/3	SRD4/5	SRD6		
1	Spring Ring	1	1	1	Stainless Steel 304	
2	Indicator Pointer	1	1	1	Stainless Steel 304	
3	Hex Head Cap Screw	3	3	3	Stainless Steel 304	
4	Indicator Plate	1	1	1	Stainless Steel 304	
5	Socket Head Bush Screws	8	8	8	Stainless Steel 304	
6	Namur stem Namur	1	1	1	Carbon Steel	Nickel coated chemically
7	Socket Head Cap Screw	6	6	6	Stainless Steel 304	
8	Cover	1	1	1	Carbon Steel	Polyester powder coated
9	Driver Arm Bearing	2	2	2	Stainless Steel w/ Acetal Lining	
10	Thrust Bearing	2	2	2	Nylon	
11	Cylindrical pin	8	8	8	Carbon Steel	
12	Driver Arm	1	1	1	Ductile Iron	Nickel coated chemically
13	Driver Housing	1	1	1	Ductile Iron	Polyester powder coated
14	Cylindrical pin	2	2	2	Stainless Steel 304	
15	Nameplate	1	1	1	Stainless Steel 304	
16	Set Screw	1	1	1	Stainless Steel 304	
16.1	Hex Jam Nut	1	1	1	Stainless Steel 304	
17	Stop screws	2	2	2	Stainless Steel	
17.1	Hex Jam Nut	2	2	2	Stainless Steel 304	
18	Breather	1	1	1	Stainless Steel 316	
19	Drive bush	1	1	1	Carbon Steel	Nickel coated chemically
20	Lock Nut	12	12	24	Stainless Steel	
21	Spring-washer	12	12	24	Stainless Steel	
22	Gasket	24	24	48	Stainless Steel	
23	Spring Housing	1	1	2	Carbon Steel	Polyester powder coated
24	Shoulder Screw	1	1	2	Carbon Steel (12.8)	
25	Clevis Bearing	1	1	2	Stainless Steel w/ Acetal Lining	
26	Clevis	1	1	2	Carbon Steel	
27	Hex Jam Nut	1	1	2	Stainless Steel 304	
28	Actuator Rod	1	1	2	Carbon Steel	
29	Hex Jam Nut	1	1	2	Carbon Steel	
30	Spring Retainer	1	1	2	Carbon Steel	Polyester powder coated
31 / 32	Compression Springs	1	1	2	55Mn Spring Steel 55Mn	Polishing+capacitance coated
33	Spring Retainer Plate	1	-	-	Carbon Steel	Polyester powder coated
34	Diaphragm Retainer Bearing Pins	12	-	-	UHMW PE	
34	Diaphragm Retainer Bearing	-	1	2	POM	
35	Diaphragm Retainer	1	1	2	Carbon Steel	Polyester powder coated
36	Hex Head Cap Screw	4	4	8	Carbon Steel	
37	Diaphragm	1	1	2	NBR/Nylon66 Fabric Blend (-25°C~70°C)	
	Diaphragm (optional)	1	1	2	LNBR/Nylon66 Fabric Blend (-40°C~70°C)	
	Diaphragm (optional)	1	1	2	EPDM4/Polyester Fabric Blend (-29°C~170°C)	
	Diaphragm (optional)	1	1	2	Viton/NOMEX Fabric Blend (-15°C~200°C)	
37.1	Retaining washer	-	1	2	Stainless steel	
37.2	Hex head cap screw	-	1	2	Stainless steel	
38	Diaphragm Cover	1	1	2	Carbon Steel	Polyester powder coated
39	Hex Head Cap Screw	12	12	24	Stainless Steel 304	